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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup>:</b> <b>A61N 5/06</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 97/46279</b> <b>(43) International Publication Date:</b> 11 December 1997 (11.12.97)
<b>(21) International Application Number:</b> PCT/SE97/00977 <b>(22) International Filing Date:</b> 4 June 1997 (04.06.97)  <b>(30) Priority Data:</b> 9602272-8      7 June 1996 (07.06.96)      SE  <b>(71) Applicant (for all designated States except US):</b> BIOLIGHT PATENT HOLDING AB [SE/SE]; Svärdvägen 15, S-182 33 Danderyd (SE).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> THIBERG, Rolf [SE/SE]; Åkersbergavägen 10, S-184 50 Åkersberga (SE).  <b>(74) Agents:</b> ÖRTENBLAD, Bertil et al.; Noréns Patentbyrå AB, P.O. Box 10198, S-100 55 Stockholm (SE).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Swedish).</i>
<b>(54) Title:</b> A DEVICE FOR EXTERNAL MEDICAL TREATMENT WITH MONOCHROMATIC LIGHT  <b>(57) Abstract</b>  Apparatus for external medical treatment with the aid of light, comprising a light-emitting device which is intended to lie against or be held in the close proximity of acupuncture points on the body of an individual, and drive means for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes or corresponding elements and is adapted to emit monochromatic light of a predetermined wavelength, wherein the drive means (8, 9, 10) is adapted to cause the light-emitting device (1) to emit the monochromatic light over a predetermined period of time, and wherein the drive device (8, 9, 10) is adapted to cause the light-emitting device (1) to pulsate the light in accordance with a predetermined pulse frequency. The invention is characterized in that the drive means (8, 9, 10) is adapted to cause the light-emitting device or light-emitting devices to emit the pulsating monochromatic light at a pulse repetition frequency in one of the ranges 5 Hz to 9.5 Hz, 22.2 Hz to 36.0 Hz or 273.8 Hz to 324.0 Hz.		

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**A DEVICE FOR EXTERNAL MEDICAL TREATMENT WITH  
MONOCHROMATIC LIGHT**

5     The present invention relates to an apparatus for external medical treatment with the aid of light, and then more specifically with light that will alleviate and/or cure different diseases, illnesses, sicknesses, etc., hereinafter referred generally as health disorders.

10    The Swedish Patent Specification No. 502 784 teaches apparatus for external medical treatment with the aid of light. The device includes light-emitting devices which are intended to lie against or be held in the close proximity of the body of an individual, and means for driving the light-emitting  
15    device, said light-emitting device including light-emitting diodes or corresponding light-emitting elements. According to this prior publication, the treatment apparatus also includes a drive means which functions to cause the light-emitting device to emit monochromatic light over a predeter-  
20    mined period of time. The drive means is also adapted to cause the light-emitting device to emit pulsating light in accordance with a predetermined series of pulse frequencies.

25    It has been found that apparatus of this kind can be used very successfully in the treatment of disorders and injuries, for instance injuries sustained in sporting activities, pulled or strained muscles, muscular pain, joint pains, headaches, different inflammatory conditions, different skin complaints, such as acne, back pains, etc., provided that the  
30    light is emitted in a certain way. Treatment with light has a favourable effect on the healing of injuries and will alleviate and/or cure various health disorders.

35    Thus, it is realized that treatment with light in which a certain light is emitted in a certain series of frequencies will have a significantly greater effect with respect to

shortening the time taken to cure or alleviate a health disorder.

5 The present invention is based on the conception that treatment corresponding to acupuncture treatment can be effected with the aid of emitted pulsating light that has a certain pulse frequency, wherein the light replaces conventional acupuncture needles.

10 The present invention thus relates to apparatus for external medical treatment with the aid of light, wherein the apparatus includes a light-emitting device which is intended to be placed against or held in the close proximity of an acupoint on the body of an individual, and a light-emitting device  
15 drive means, wherein the light-emitting device includes light-emitting diodes or corresponding light-emitting elements, wherein the light-emitting device is adapted to emit monochromatic light of a predetermined wavelength, wherein the drive device is adapted to cause the light-emitting device to emit said monochromatic light over a  
20 predetermined period of time, and wherein the drive device is adapted to cause the light-emitting device to emit light that pulsates in accordance with a predetermined pulse frequency. The apparatus is characterized in that the drive  
25 device is operative in causing the light-emitting device or elements to emit said pulsating monochromatic light at a pulse repetition frequency in one of the ranges 5 Hz to 9.5 Hz, 22.2. Hz to 36.0 Hz or 273.8 Hz to 324.0 Hz.

30 The invention will now be described in more detail with reference to exemplifying embodiments and also with reference to the accompanying drawings, in which

- Figure 1 is a block schematic of the inventive apparatus;
- 35 - Figure 2 is a side view of a light-emitting device; and
- Figure 3 illustrates a modified construction of an inventive apparatus.

Figures 1 and 2 illustrate apparatus for external medical treatment with the aid of light. The apparatus includes a light-emitting device 1, which is intended to lie against or to be held in the close proximity of the body of an individual. Figure 2 shows the light-emitting device from one side, while Figure 1 shows the element from beneath. The light-emitting device includes a housing 5 which is provided with a transparent plate 6. Located beneath the plate 6 is a surface 2 on which a plurality of light-emitting diodes 3, 4 or corresponding light-emitting elements are mounted. The light-emitting diodes send light through the plate 6 when the diodes are energized, i.e. supplied with current through a cable 7. In use, the housing 5 is held so that the plate 6 will lie against the relevant part of the body. The apparatus also includes drive means 8, 9, 10 for driving the light-emitting device 1. The light-emitting device 1 may include light-emitting diodes 3 or corresponding means for emitting infrared light. These diodes or the like are marked with solid circles in Figure 1.

The drive means 8, 9, 10 are adapted to cause the light-emitting device 1 to emit monochromatic light of a given wavelength over a predetermined time period. The drive means may also be adapted to emit monochromatic light of a wavelength different to the first-mentioned wavelength over a second predetermined time period, in an optional second stage of the treatment. Visible light is emitted with the aid of light-emitting diodes 4 or corresponding elements. These diodes are marked with hollow circles in Figure 1.

The drive means 8, 9, 10 are also adapted to cause the light-emitting device 1 to emit pulsating light in accordance with a predetermined pulse frequency or a series of pulse frequencies over predetermined time periods. The drive means include a computer 8 which functions to control drive circuits 9, 10, to which voltage is applied for driving the light-emitting diodes via conductors 11, 12.

The computer and drive circuits are of an appropriate known kind. Connected to the drive means is a keyboard 13 by means of which the operator can enter drive means control data for actuating the light-emitting device in a desired manner. The apparatus will also conveniently include a display 14, on which the settings made through the keyboard are displayed.

Infrared light-emitting diodes 3 are preferably semi-conductor diodes of the GaAs kind (Gallium arsenide). The light-emitting diodes 4 that emit visible light are also preferably of the GaAs type.

For instance, the number of light-emitting diodes included in the light-emitting device may be such that the infrared light-emitting diodes will together generate a light power of 1800 milliwatts, and the diodes that emit visible light may each have a power of 3000 millicandela.

According to one embodiment of the invention, the light-emitting device 1 includes red light emitting diodes 4 that emit visible light at the wavelength of 660 nanometers and/or infrared light emitting diodes that emit light at the wavelength of 950 nanometers.

In another embodiment of the invention, the light-emitting device 1 includes light-emitting diodes 4 that emit a substantially monochromatic visible light in one of the colours violet, blue, yellow, orange, red or green.

The subject matter described above with reference to the accompanying drawings is essentially also found described in the aforementioned patent specification.

According to the invention, the drive means 8, 9, 10 are adapted to cause the light-emitting device or elements to emit said pulsating monochromatic light at a pulse repetition

frequency in one of the ranges 5 Hz to 9.5 Hz, 22.2 Hz to 36.0 Hz or 273.8 Hz to 324.0 Hz.

5 It has surprisingly been found that the inventive apparatus can be used for acupuncture treatment in a manner corresponding to acupuncture treatment with the aid of conventional acupuncture needles.

10 It has also surprisingly been found that the treatment, i.e. stimulation of the acupoints, is effected much more quickly than conventional acupuncture. Normally, each acupoint need only be treated for a period of about one minute, as compared with treatment for from about five minutes to up to an hour with conventional acupuncture. Furthermore, the patient need  
15 not feel any pain.

The present invention thus represents considerable steps forward in the art. Treatment is effected in the same way as conventional acupuncture, although, with the difference, that  
20 the light-emitting device is placed over the acupoint in question instead of needles, and the therapist then activates the light-emitting device such as to emit desired monochromatic light in accordance with a desired pulse repetition frequency.

25 Because the light-emitting device has a relatively large irradiating surface area, the acupoint in question can be found easily. It will be understood that the illuminating, or irradiating, surface area of the light-emitting device can  
30 be adapted so that a smaller surface can be made illuminating, or irradiating, for treatment at acupoints which are relatively close together, so as to avoid treating acupoints that shall not be treated when treating a specific acupoint.

35 Three ranges of pulse repetition frequencies have been mentioned in the foregoing. The intermediate range of 22.2-36.0 Hz is preferably used against so-called specific

acupoints. The highest range is used for so-called weighted acupoints found on feet and hands. The lowest range is used for so-called reflex points, which are found on the ears.

5 The invention is not concerned with the question of which of the aforesaid monochromatic light shall best be used for different treatments. The wavelength of the light is chosen to give the intended treatment effect, depending on the health disorder or injury to be treated and also on which  
10 acupoints shall be included in the treatment.

The drive means includes selector means of known kind with which the operator can choose a pulse repetition frequency that lies within each of said ranges. For instance, the  
15 selector means may include the aforesaid keyboard by means of which desired pulse repetition frequencies are set. The chosen setting will suitably be shown in the display.

According to a preferred embodiment of the invention, the  
20 light-emitting device includes at least two separate light-emitting elements 1, 15; see Figure 3. The light-emitting elements are adapted to emit monochromatic light of mutually the same wavelength. Both elements are connected to the drive means 8, 9, 10. When more than two light-emitting elements  
25 are included, as indicated with the light-emitting element 16 shown in broken lines in Figure 3, all said elements are connected to the drive means. The drive means functions to cause each of the light-emitting elements to emit the monochromatic light synchronously in accordance with a  
30 predetermined selected pulse frequency. This embodiment thus enables two or more acupoints to be treated simultaneously.

According to one embodiment, the light-emitting device is adapted to emit monochromatic light of different wavelengths.  
35 In this case, the drive means function to cause the light-emitting device to emit solely light of one wavelength at each time point. The drive means is provided with a selector



means of known kind, for instance a selector means in which the operator can enter, and therewith select, a desired wavelength. Selected wavelengths will conveniently be shown on the display.

5

It will be apparent that the illustrated and described light-emitting device can be modified. For instance, the device may have form of a light pen that emits a light point having a diameter of, e.g., 0.5 cm to 2 cm.

10

It will be understood that the invention is not restricted to the aforescribed and illustrated exemplifying embodiments thereof and that modifications and variations can be made within the scope of the following Claims.

## CLAIMS

1. Apparatus for external medical treatment with the aid of light, comprising a light-emitting device which is intended to lie against or be held in the close proximity of acupuncture points on the body of an individual, and drive means for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes or corresponding elements and is adapted to emit monochromatic light of a predetermined wavelength, wherein the drive means (8, 9, 10) is adapted to cause the light-emitting device (1) to emit said monochromatic light over a predetermined period of time, and wherein the drive device (8, 9, 10) is adapted to cause the light-emitting device (1) to pulsate said light in accordance with a predetermined pulse sequence, characterized in that the drive means (8, 9, 10) is adapted to cause the light-emitting device or light-emitting devices to emit said pulsating monochromatic light at a pulse repetition frequency in one of the ranges 5 Hz to 9.5 Hz, 22.2 Hz to 36.0 Hz or 273.8 Hz to 324.0 Hz.

2. Apparatus according to Claim 1, characterized in that the light-emitting device includes two separate light-emitting elements (1, 15); in that the two light-emitting elements (1, 15) are adapted to emit monochromatic light of the same wavelength; and in that the drive means (8, 9, 10) is adapted to cause each of the light-emitting elements to emit light synchronously in accordance with a predetermined pulse frequency.

3. Apparatus according to Claim 1 or 2, characterized in that the light-emitting device (1) is adapted to emit monochromatic light at different wavelengths; and in that the drive means (8, 9, 10) is adapted to cause the light-emitting device to emit solely light of one wavelength at each time point.

Fig. 1

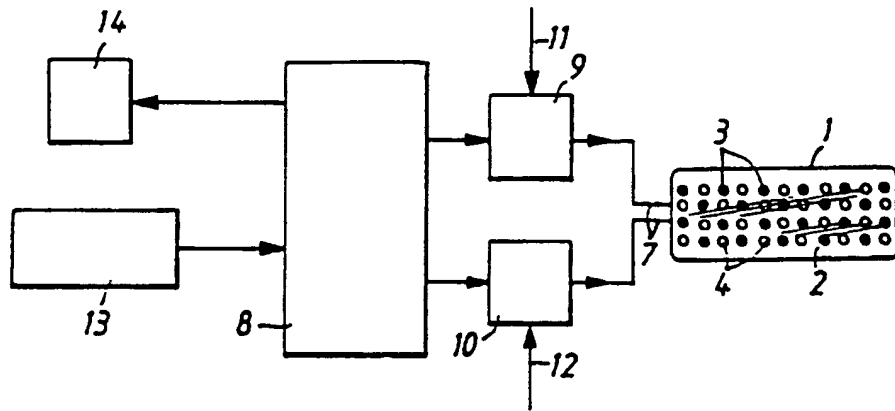
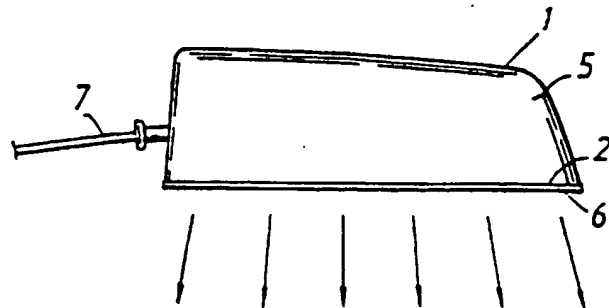
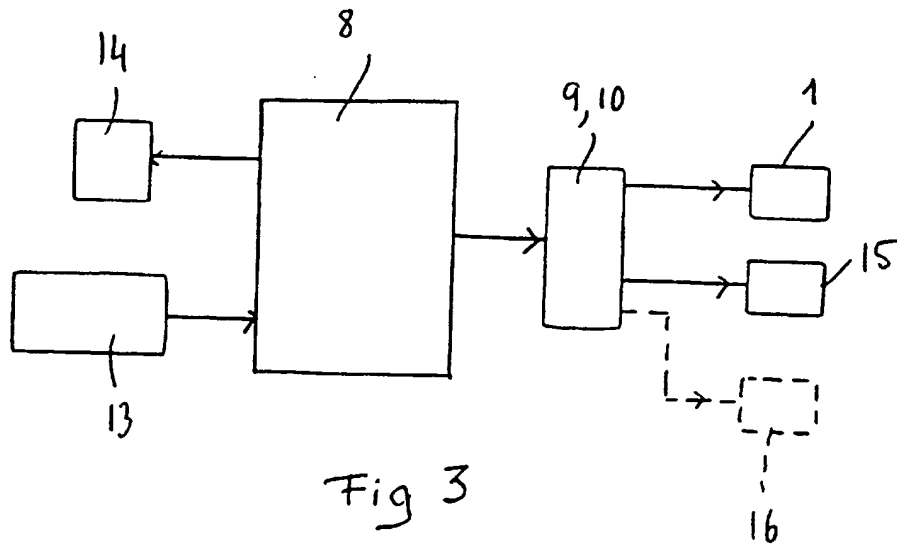


Fig. 2





## INTERNATIONAL SEARCH REPORT

International application No. -

PCT/SE 97/00977

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
<b>IPC6: A61N 5/06</b> According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
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<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
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01/09/97

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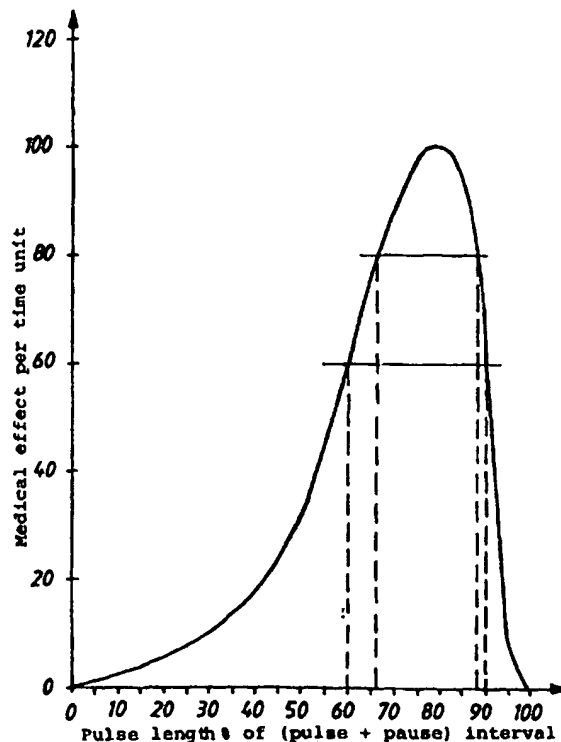
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(51) International Patent Classification <sup>6</sup> : <b>A61N 5/06</b>		A1	(11) International Publication Number: <b>WO 97/46280</b>
			(43) International Publication Date: 11 December 1997 (11.12.97)
(21) International Application Number: PCT/SE97/00978 (22) International Filing Date: 4 June 1997 (04.06.97) (30) Priority Data: 9602273-6 7 June 1996 (07.06.96) SE (71) Applicant (for all designated States except US): BIOLIGHT PATENT HOLDING AB [SE/SE]; Svärdvägen 15, S-182 33 Danderyd (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): THIBERG, Rolf [SE/SE]; Åkersbergavägen 10, S-184 50 Åkersberga (SE). (74) Agents: ÖRTENBLAD, Bertil et al.; Noréns Patentbyrå AB, P.O. Box 10198, S-100 55 Stockholm (SE).		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Swedish).	

(54) Title: DEVICE FOR EXTERNAL TREATMENT WITH PULSATING LIGHT OF HIGH DUTY CYCLE

(57) Abstract

Apparatus for external medical treatment with light, comprising a light-emitting device which is intended to lie against or to be held in the close proximity of the body of an individual, and a drive device for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes or corresponding elements and is adapted to emit monochromatic light of a first wavelength, wherein the drive device (8, 9, 10) is adapted to cause the light-emitting device (1) to emit the monochromatic light over a first predetermined time period in a first stage and thereafter emit selectively monochromatic light of a different wavelength than the first wavelength over a second predetermined time period in a possible second stage, and wherein the drive device (8, 9, 10) is adapted to cause the light-emitting device (1) to pulsate the emitted light in accordance with a predetermined pulse frequency or series of pulse frequencies over the time periods. The invention is characterized in that the drive device (8, 9, 10) is adapted to cause the light-emitting devices to emit the pulsating light with a pulse length that lies within an interval of about 60 % to 90 % of the time between respective start edges (18, 19) of two mutually sequential pulses (15).



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## DEVICE FOR EXTERNAL TREATMENT WITH PULSATING LIGHT OF HIGH DUTY CYCLE

The present invention relates to apparatus for external medical treatment with light, and more specifically light that will alleviate and/or cure different sicknesses, illnesses, diseases, etc., hereinafter referred to as health disorders.

It has been found that infrared light has a favourable effect in this regard.

Swedish Patent Specification No. 502 784 teaches apparatus for external medical treatment with light, comprising a light-emitting device which is intended to lie against or be held in the close proximity of the body of an individual, and drive means for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes or corresponding light-emitting elements and is adapted to emit infrared light. The invention according to this patent is mainly characterized in that the drive device is adapted to cause the light-emitting device to emit light over a predetermined period of time in a first stage, and thereafter to emit visible light over a second predetermined period of time in a second stage; and in that the drive device is adapted to cause the light-emitting device to pulsate the emitted infrared light and the visible light respectively in accordance with a predetermined series of pulse frequencies.

It has been found that such apparatus can be used very successfully in the treatment of other disorders and injuries, for instance injuries sustained in sporting activities, pulled or strained muscles, muscular pain, joint pains, headaches, different inflammatory conditions, different skin complaints, such as acne, back pains, etc., provided that the light is emitted in a certain way. Treatment with light has a favourable effect on the healing of injuries and will alleviate and/or cure various health disorders.

Thus, it is realized that treatment with light in which a certain light is emitted in a certain series of frequencies will have a significantly greater effect with respect to shortening the time taken to cure or alleviate a health disorder.

It has also been found that treatment with solely one or more monochromatic lights other than infrared light, such as visible light of different colours, emitted in accordance with a certain pulse frequency gives a very good treatment result.

The present invention is based on the insight that the pulse length of emitted pulsating light of a given pulse frequency has a great effect on the result of the treatment.

The present invention thus relates to apparatus for external medical treatment with light, wherein the apparatus includes a light-emitting device which is intended to lie against or to be held in the close proximity of the body of an individual, and a drive device for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes or corresponding elements and is adapted to emit monochromatic light of a first wavelength, wherein the drive device is adapted to cause the light-emitting device to emit said monochromatic light over a predetermined first time period in a first stage, and thereafter to emit selectively monochromatic light of a different wavelength to the first wavelength over a second predetermined time period in a possible second stage, and wherein the drive device is adapted to cause the light-emitting device to pulsate said emitted light in accordance with a predetermined pulse frequency or series of pulse frequencies over said time periods, and wherein the apparatus is characterized in that the drive device is adapted to cause the light-emitting devices to emit said pulsating light with a pulse length that lies within an interval of about 60% to 90% of the time

between respective start edges of two mutually sequential pulses.

The invention will now be described in more detail with  
5 reference to exemplifying embodiments thereof and also with  
reference to the accompanying drawings, wherein

- Figure 1 illustrates the inventive apparatus schematically and in block form;
- 10 - Figure 2 is a side view of a light-emitting device;
- Figure 3 is a diagram; and
- Figure 4 illustrates pulsed light.

Figures 1 and 2 illustrate apparatus for external medical  
15 treatment with the aid of light. The apparatus includes a  
light-emitting device 1, which is intended to lie against or  
to be held in the close proximity of the body of an individual. Figure 2 shows the light-emitting device from one side,  
while Figure 1 shows the element from beneath. The light-  
20 emitting device includes a housing 5 which is provided with  
a transparent plate 6. Located beneath the plate 6 is a  
surface 2 on which a plurality of light-emitting diodes 3,  
4 or corresponding light-emitting elements are mounted. The  
light-emitting diodes send light through the plate 6 when the  
25 diodes are energized, i.e. supplied with current through a  
cable 7. In use, the housing 5 is held so that the plate 6  
will lie against the relevant part of the body. The apparatus  
also includes drive means 8, 9, 10 for driving the light-  
emitting device 1. The light-emitting device 1 may include  
30 light-emitting diodes 3 or corresponding means for emitting  
infrared light. These diodes or the like are marked with  
solid circles in Figure 1.

The drive means 8, 9, 10 are adapted to cause the light-  
35 emitting device 1 to emit monochromatic light of a given  
wavelength over a predetermined time period. The drive means  
may also be adapted to emit monochromatic light of a wave-

length different to the first-mentioned wavelength over a second predetermined time period, in an optional second stage of the treatment. Visible light is emitted with the aid of light-emitting diodes 4 or corresponding elements. These diodes are marked with hollow circles in Figure 1.

The drive means 8, 9, 10 are also adapted to cause the light-emitting device 1 to emit pulsating light in accordance with a predetermined pulse frequency or a series of pulse frequencies over predetermined time periods. The drive means include a computer 8 which functions to control drive circuits 9, 10, to which voltage is applied for driving the light-emitting diodes via conductors 11, 12.

The computer and drive circuits are of an appropriate known kind. Connected to the drive means is a keyboard 13 by means of which the operator can enter drive means control data for actuating the light-emitting device in a desired manner. The apparatus will also conveniently include a display 14, on which the settings made through the keyboard are displayed.

Infrared light-emitting diodes 3 are preferably semiconductor diodes of the GaAs kind (Gallium arsenide). The light-emitting diodes 4 that emit visible light are also preferably of the GaAs type.

For instance, the number of light-emitting diodes included in the light-emitting device may be such that the infrared light-emitting diodes will together generate a light power of 1800 milliwatts, and the diodes that emit visible light may each have a power of 3000 millicandela.

According to one embodiment of the invention, the light-emitting device 1 includes red light emitting diodes 4 that emit visible light at the wavelength of 660 nanometers and/or infrared light emitting diodes that emit light at the wavelength of 950 nanometers.

In another embodiment of the invention, the light-emitting device 1 includes light-emitting diodes 4 that emit a substantially monochromatic visible light in one of the colours violet, blue, yellow, orange, red or green.

5

The visible light used will depend on the disorder or type of injury to be treated.

10 The subject matter described above with reference to the accompanying drawings is essentially also found described in the aforementioned patent specification.

15 According to the invention, the drive device is adapted to cause the light-emitting device or elements to emit said pulsating monochromatic light at a pulse length that lies within an interval of about 60% to 90% of the time between respective start edges 18, 19 of two mutually sequential pulses 15.

20 Figure 4 is a schematic illustration of emitted light pulses, where amplitude V is shown on the Y-axis and time t on the X-axis. The duration of a pulse 15 is referenced 16 and the total pulse time plus a subsequent pause is referenced 17.

25 The medical effect per unit of time is shown on the Y-axis of the diagramme in Figure 3. This is a subjective measurement of the medical effect achieved, but is a result of tests of long duration and can therefore be considered highly reliable. The maximum value of the Y-axis is 100%. The X-axis  
30 shows the pulse length 16 as a percentage of the total time 17 of a pulse plus a subsequent pause, i.e. there is no pause between the pulses.

35 As Figure 3 surprisingly shows, the curve has a maximum at a value of about 79% on the X-axis, whereafter the curve falls steeply to zero with respect to medical effect.

The treatment interval is therewith relatively narrow, and lies between 60% and 90% on the X-axis. A medical effect of at lowest 60% is obtained within this interval.

5        However, the interval is narrower in accordance with one preferred embodiment. According to this preferred embodiment, the pulse length lies within an interval of about 67% to 88% of the time between respective start edges of two mutually sequential pulses, i.e. from 67% to 88% on the X-axis. The  
10        medical effect is at lowest 80% within this interval.

It will be evident that realization of the circumstances reflected in Figure 3 are of the greatest significance in the external medical treatment of disorders and injuries with  
15        light. The present invention thus provides considerable advances in this field. It should be mentioned that application of the present invention is not restricted to the treatment of patients in accordance with the prior patent publication mentioned in the introduction but can also be  
20        applied in the acupuncture treatment of patients with light as described in Swedish Patent Specification No. 9602272-8.

The present invention is not therefore restricted to the  
aforedescribed and illustrated exemplifying embodiments  
25        thereof, since modifications and variations can be made within the scope of the following Claims.



## CLAIMS

1. Apparatus for external medical treatment with light, comprising a light-emitting device which is intended to lie against or to be held in the close proximity of the body of an individual, and a drive device for driving the light-emitting device, wherein the light-emitting device includes light-emitting diodes or corresponding elements and is adapted to emit monochromatic light of a first wavelength, wherein the drive device (8, 9, 10) is adapted to cause the light-emitting device (1) to emit said monochromatic light over a first predetermined time period in a first stage and thereafter emit selectively monochromatic light of a different wavelength than said first wavelength over a second predetermined time period in a possible second stage, and wherein the drive device (8, 9, 10) is adapted to cause the light-emitting device (1) to pulsate said emitted light in accordance with a predetermined pulse frequency or series of pulse frequencies over said time periods, characterized in that the drive device (8, 9, 10) is adapted to cause said light-emitting devices to emit said pulsating light with a pulse length that lies within an interval of about 60% to 90% of the time between respective start edges (18, 19) of two mutually sequential pulses (15).

25

2. Apparatus according to Claim 1, characterized in that the pulse length lies within an interval of about 67% to 88% of the time between the respective start edges of two mutually sequential pulses.

Fig. 1

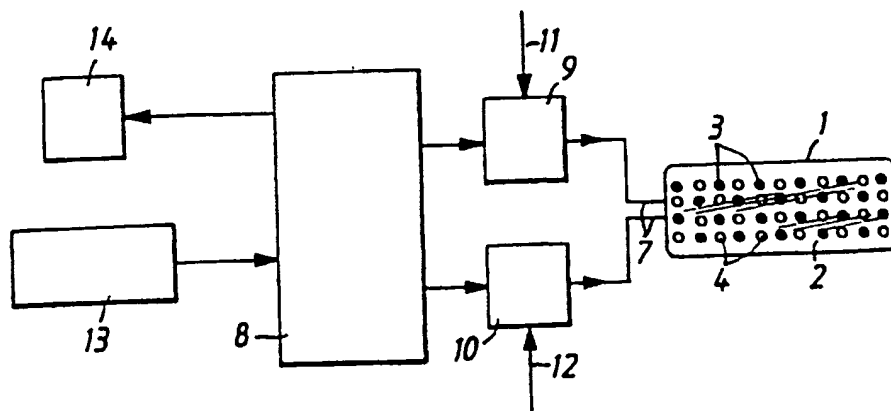
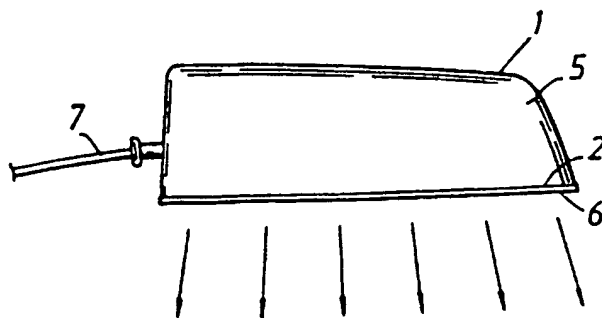


Fig. 2



2 / 2

Fig. 3

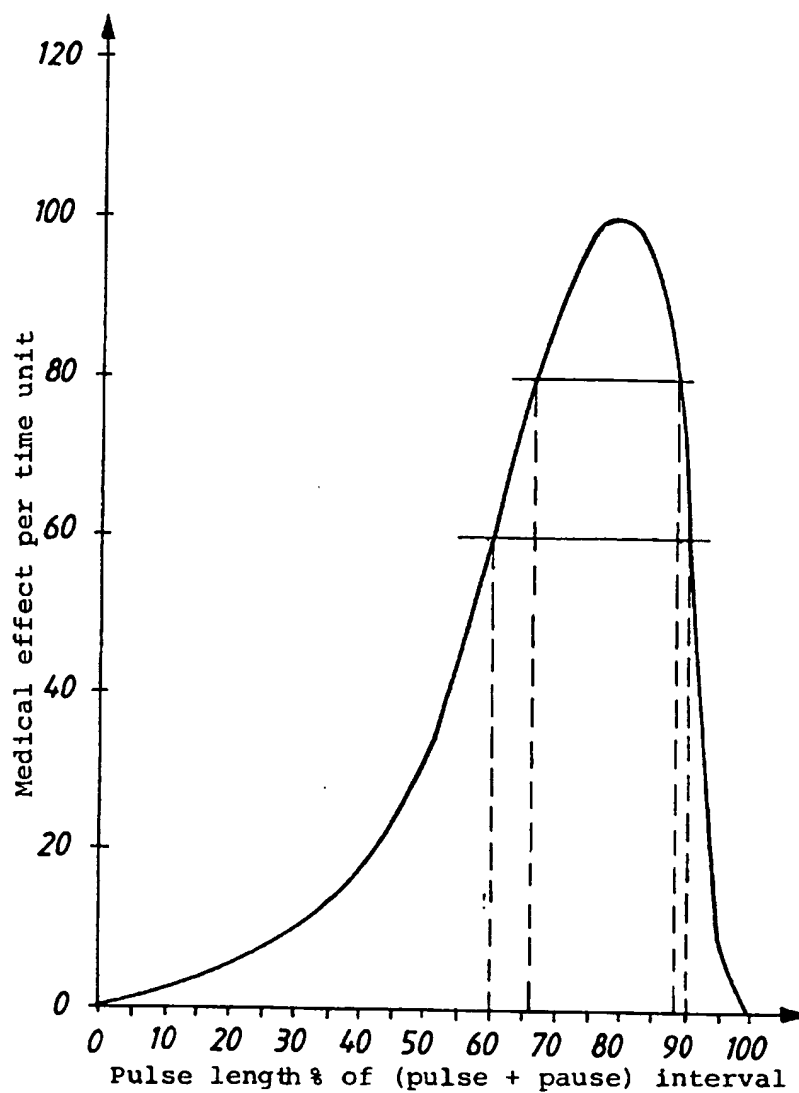
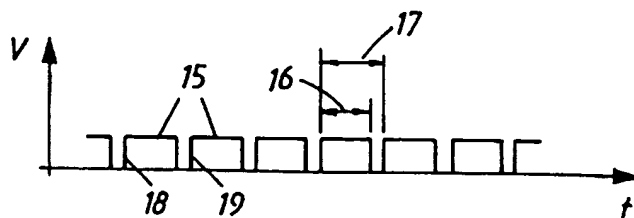


Fig. 4



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00978

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61N 5/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	Lasers in Surgery and Medicine, Volume 17, 1995, Basim Mokhtar et al, "Double-Blind, Placebo-Controlled Investigation of the Effect of Combined Phototherapy/Low Intensity Laser Therapy Upon Experimental Ischaemic Pain in Humans", page 74 - page 81, see page 77, right column --	1,2
X	DE 2548354 A1 (MESSERSCHMITT-BÖLKOW-BLOHM GMBH), 5 May 1977 (05.05.77), see page 10. figure 4 and claim 4 --	1-2
X	WO 9220403 A1 (LASB LASER, CORP.), 26 November 1992 (26.11.92), see pages 1-3, 6 and claims --	1

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

Date of mailing of the international search report

25 Sept 1997

30 -09- 1997

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## INTERNATIONAL SEARCH REPORT

International application No. -

PCT/SE 97/00978

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	US 5358503 A (DALE E. BERTWELL ET AL), 25 October 1994 (25.10.94), see column 5, lines 23-25 and claims  --	
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A	US 5259380 A (EMANUEL MENDES ET AL), 9 November 1993 (09.11.93), see claim 11 and column 5  --	1,2
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Information on patent family members

01/09/97

International application No.

PCT/SE 97/00978

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